CLAIMS

I Claim:

1. A polymerization catalyst comprising a Group 3 to 12 transition metal or a Group 13 or 14 main group metal, wherein the metal is coordinated to a dianionic tridentate ligand wherein the ligand includes a Group 15 element in a negative electronic state, a Group 16 atom in a negative electronic state, and a Group 15 element in a neutral electronic state.

2. A polymerization catalyst system comprising an activator and a metal compound of a Group 3 to 12 transition metal or a Group 13 or 14 main group metal or a metal of the lanthanide series wherein the metal is coordinated to a dianionic tridentate ligand of one of the following formulae:

$[Z\text{-}A^1\text{-}X\text{-}R^1]^{-2}$ or

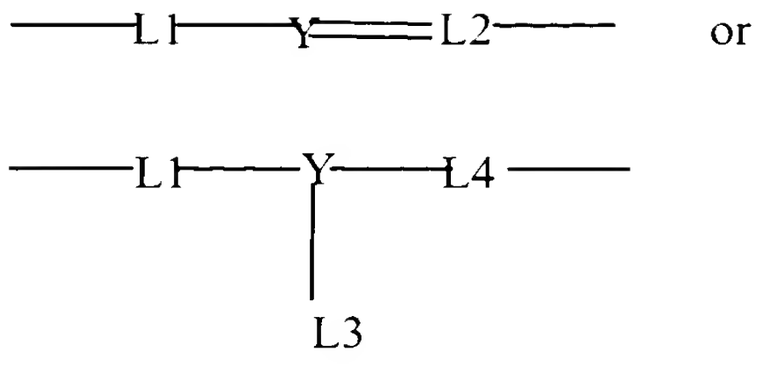
$[Z\text{-}R^2\text{-}X\text{-}A^2]^{-2}$ or

$[Z\text{-}R^3(A^3)\text{-}X\text{-}R^1]^{-2}$ or

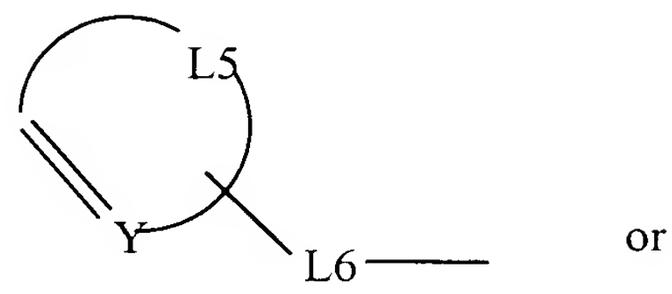
$[Z\text{-}R^2\text{-}A^4\text{-}X\text{-}R^1]^{-2}$

wherein Z is a Group 16 atom, X is a Group 15 atom, R^1 is a group that may be halogen substituted and is an alkyl, cycloalkyl, heteroalkyl, heterocycloalkyl, aryl, heteroaryl, alkylaryl, or arylalkyl radical and may have some carbon atom positions substituted with other Group 14 atoms, R^2 is a group that may be halogen substituted and is an alkylene, cycloalkylene, heteroalkylene, heterocycloalkylene, arylene, heteroarylene, alkylaryl, or arylalkyl diradical and may have some carbon atom positions substituted with other Group 14 atoms, R^3 is a group that may be halogen substituted and is an alkanetriyl cycloalkanetriyl or an aryltriyl triradical and may have some carbon atom positions substituted with other Group 14 atoms, A^1 through A^4 are linking structures of the following formulae:

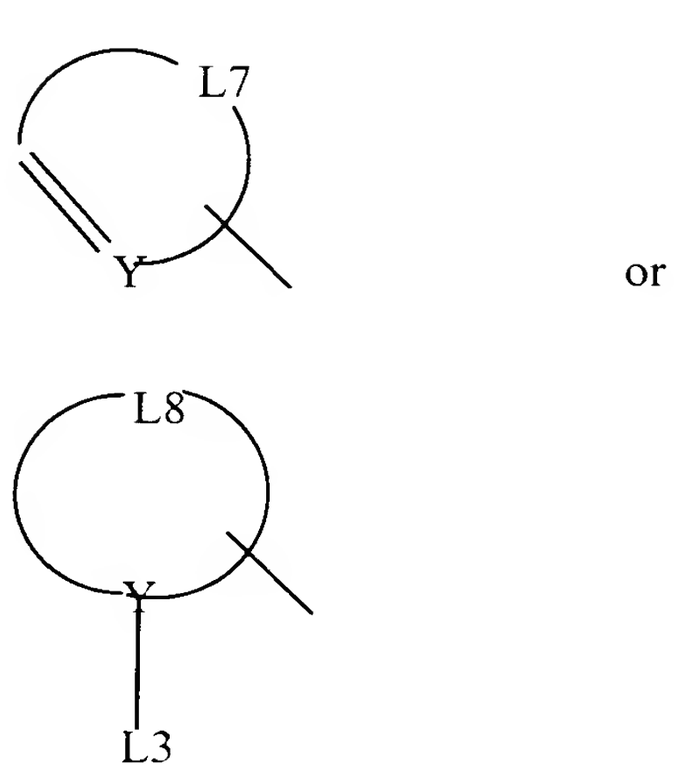
for A^1



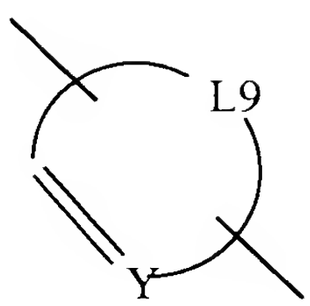
for A^2



for A^3



for A^4



wherein L^1 through L^9 may contain other heteroatoms in addition to the X and Z already in the dianion, wherein Y is a Group 15 atom, L^3 is hydrogen, or an alkyl, aryl, alkylaryl, or arylalkyl radical that may have some carbon atom positions substituted with other Group 14 atoms, L^1, L^4 and L^6 are each independently an alkylene, arylene, alkylaryl, or arylalkyl diradical that may have some carbon atom positions substituted with other Group 14 atoms, L^2 and L^8 are an alkanetriyl triradical, L^5 and L^7 are an alkanetetrayl tetraradical that may contain sites of unsaturation, L^9 is an alkanepentayl pentaradical that may contain sites of unsaturation, and the tridentate ligand coordinates to the metal through its X, Y and Z group 15 an 16 atoms.

3. The polymerization catalyst of claim 2 wherein the metal a Group 3 (including lanthanides), 4, 5, or 6 metal.

4. The polymerization catalyst of claim 3 wherein the metal is a Group 4 metal

5. The polymerization catalyst of claim 2 wherein X and Y are nitrogen or phosphorous.

6. The polymerization catalyst of claim 2 wherein Z is oxygen or sulfur.

7. The polymerization catalyst of claim 2 wherein X and Y are nitrogen an Z is oxygen.

8. The polymerization catalyst of claim 2 wherein R^1 is a C_1 to C_{20} hydrocarbyl or heteroatom containing hydrocarbyl group; R^2 is a C_1 to C_{20} hydrocarbyl or heteroatom containing hydrocarbyl group; R^3 is a C_1 to C_{20} hydrocarbyl or heteroatom containing hydrocarbyl group, L^3 is a C_1 to C_{20} alkyl, cycloalkyl, heteroalkyl, heterocycloalkyl, aryl, heteroaryl, cycloalkyl, alkylaryl, or arylalkyl radical; L^1, L^4 and L^6 are a C_1 to C_{12} alkylene, heteroalkylene, cycloalkylene, heterocycloalkylene, arylene, heteroarylene, alkylaryl, or arylalkyl; L^2 is a C_2 to C_{12} alkanetriyl group; L^8 is a C_1 to C_{12} alkanetriy or heteroalkanetriyl group; L^5 and L^7 are a C_1 to C_7 hydrocarbyl or heterohydrocarbyl group; and L^9 is a C_1 to C_{20} hydrocarbyl or heterohydrocarbyl group.

9. The polymerization catalyst of claim 2 wherein R^1 is a C_2 to C_{20} alkyl, aryl or arylalkyl group, more preferably a cyclic C_5 to C_{20} alkyl group.

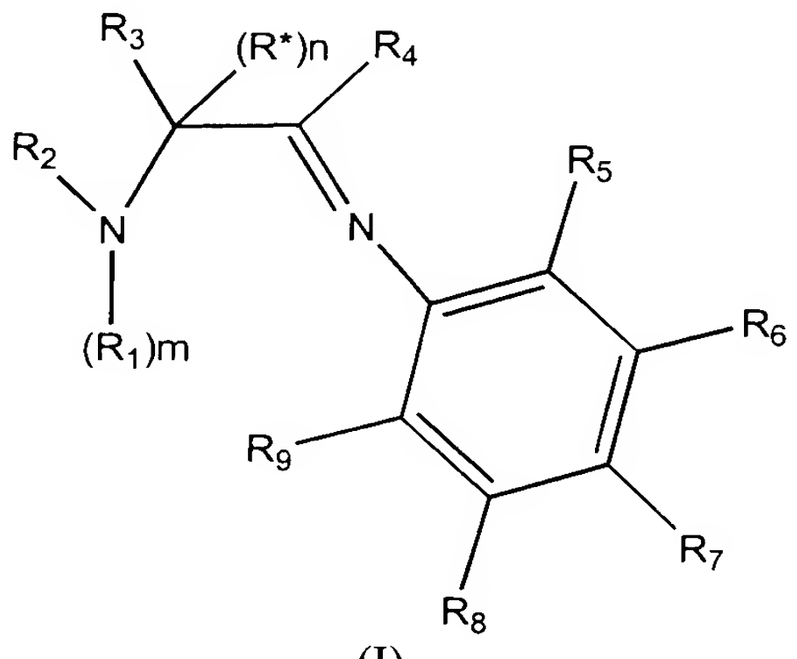
10. The polymerization catalyst of claim 2 wherein R^1 is 2,6-diisopropyl phenyl or 2,4,6 trimethyl phenyl.

11. The polymerization catalyst of claim 2 wherein R^2 is a to C_{20} alkylene, arylene, alkylaryl, or arylalkyl diradical.

12. The polymerization catalyst of claim 2 wherein R^3 is a C_3 to C_6 alkanetriyl triradical.

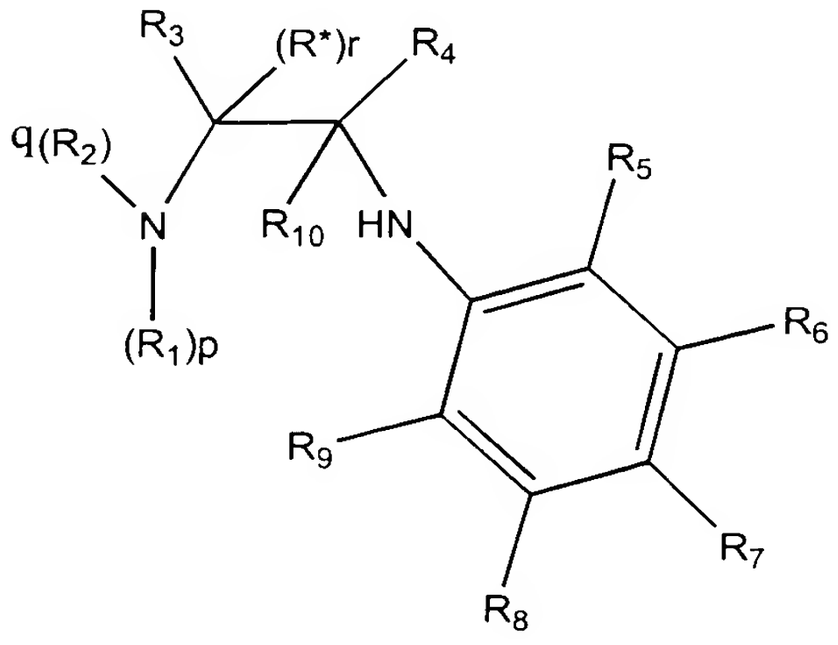
13. The polymerization catalyst of claim 2 wherein the activator is an alumoxane, a non-coordinating anion or a modified methyl alumoxane.

14. An polymerization catalyst comprising a combination of at least one activator and a reaction product of a transition metal compound with a tridentate ligand generating composition represented by a formula of:



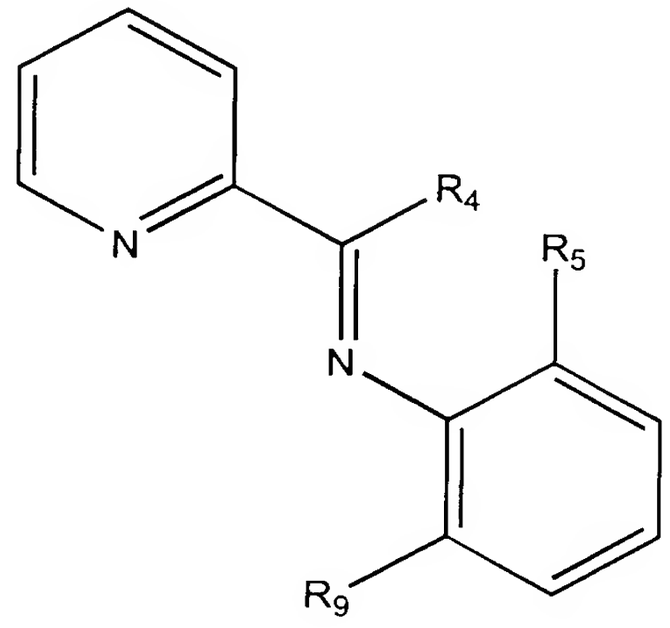
(I)

or



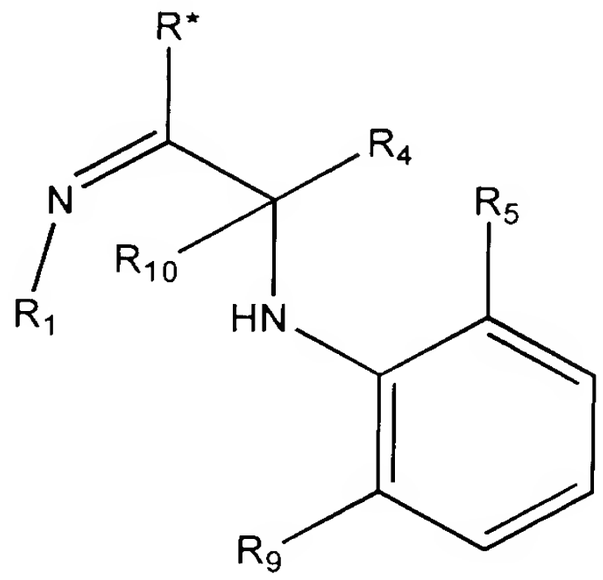
wherein: R_2 and R_3 are hydrocarbyl radicals or substituted hydrocarbyl radicals, R_5 - R_8 are each, independently, hydrogen, a hydrocarbyl radical or a substituted hydrocarbyl radical; one of R_1, R_2, R_3, R_4, or R_9 is a radical that contains a Group 16 atom and R* is a hydrocarbyl radical or substituted hydrocarbyl radical when R_1 is a radical that contains a Group 16 atom, otherwise R_1, R_2, R_3, R_4, R_9 and R* are each, independently, hydrogen, a hydrocarbyl radical or a substituted hydrocarbyl radical; and for formula (I) m and n are values of 0 or 1, and when m is 0 and n is 0 R_2 and R_3 may be joined together to form an aromatic ring structure, and when n is 0 and m is 1 R_2 and R_3 may be joined together to form ring structures; any two adjacent groups of R_5 to R_9 may be joined together to form ring structures; for formula (II) R_1 through R_9 and R* are as explained above and R_{10} is hydrogen, a hydrocarbyl radical or a substituted hydrocarbyl radical; and p, q and r are values of 0 or 1 wherein p is 0 only when q is 1 and r is 0.

15. The polymerization catalyst of claim 14 wherein the tridentate ligand generating compound is represented by the formula:



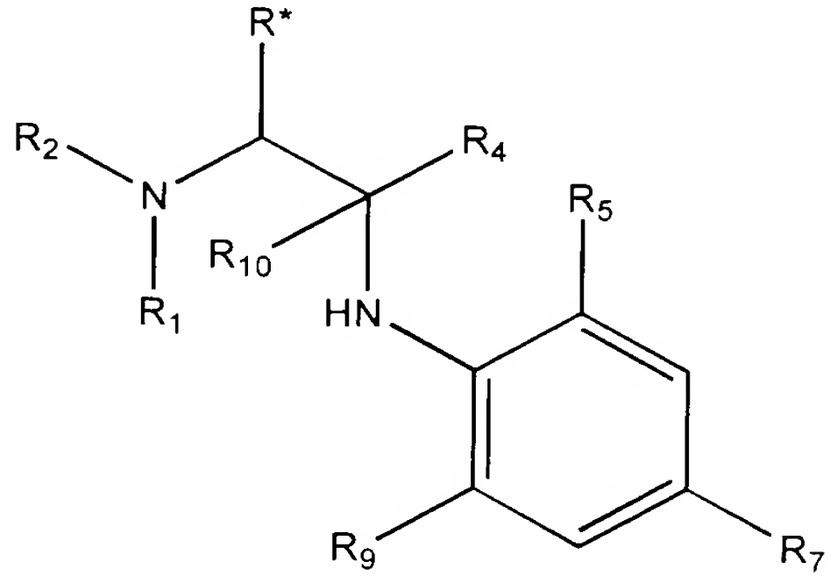
wherein R_4 is a radical that contains an oxygen based functional group selected from an alcohol, an aldehyde, a ketone, or an epoxide and R_5 and R_9 are alkyl radicals.

16. The polymerization catalyst of claim 14 wherein the tridentate ligand generating compound is represented by the formula:



wherein R_1 is a radical that contains an oxygen based functional group such as an alcohol, an aldehyde, a ketone, an epoxide and R*, R_4, R_5, R_9, and R_{10} are hydrocarbyl radicals.

17. The polymerization catalyst of claim 14 wherein the tridentate ligand generating compound is represented by the formula:



wherein R_1 is a radical that contains an oxygen based functional group selected from an alcohol, an aldehyde, a ketone, an epoxide and R*, R_2, R_4, R_5, R_7, R_9, and R_{10} are hydrocarbyl radicals.

18. The polymerization catalyst of claim 14 wherein the transition metal compound is of a Group 4 metal.

19. The polymerization catalyst of claim 18 wherein the transition metal is Zr.

20. The polymerization catalyst of claim 14 wherein the oxygen containing ligand of the catalyst when bonded to the transition metal forms a ring of 5 to 8 atoms.

21. The polymerization catalyst of claim 14 wherein the oxygen containing ligand of the catalyst when bonded to the transition metal forms a ring of 5 to 7 atoms.

22. The polymerization catalyst of claim 14 wherein the oxygen containing ligand of the catalyst when bonded to the transition metal forms a ring of 6 atoms.

23. The polymerization catalyst of claim 14 wherein the oxygen based functional group is a ketone.

24. The polymerization catalyst of claim 14 wherein the oxygen based functional group is an alcohol.

25. The polymerization catalyst of claim 14 wherein the a Group 16 atom is a sulfur based functional group.

26. Process to polymerize olefins comprising contacting an olefin with a catalyst composition according to claim 1.

27. The process of claim 26 wherein the olefin comprises one or more monomers having 2 to 30 carbon atoms.